Haw Creek Risk Assessment and Response

A Case Study of a No-Adverse-Impact Flood Risk Management Approach

Operation Stay Afloat

Indianapolis

March 15, 2012

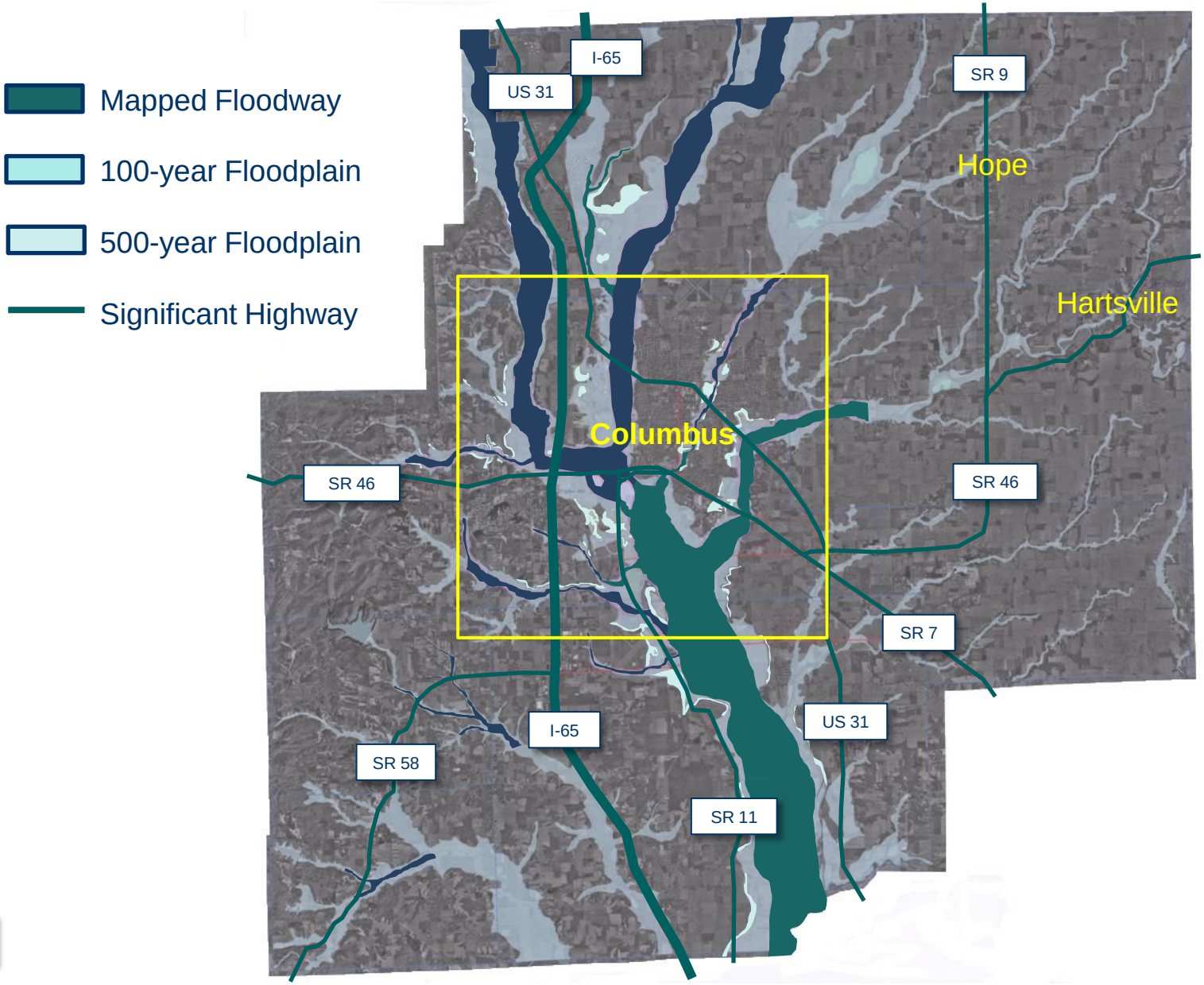
Jeff Bergman, AICP
Planning Director
City of Columbus

Siavash Beik, PE, CFM, D.WRE
Director, Water Resources
Christopher B. Burke Engineering, LLC

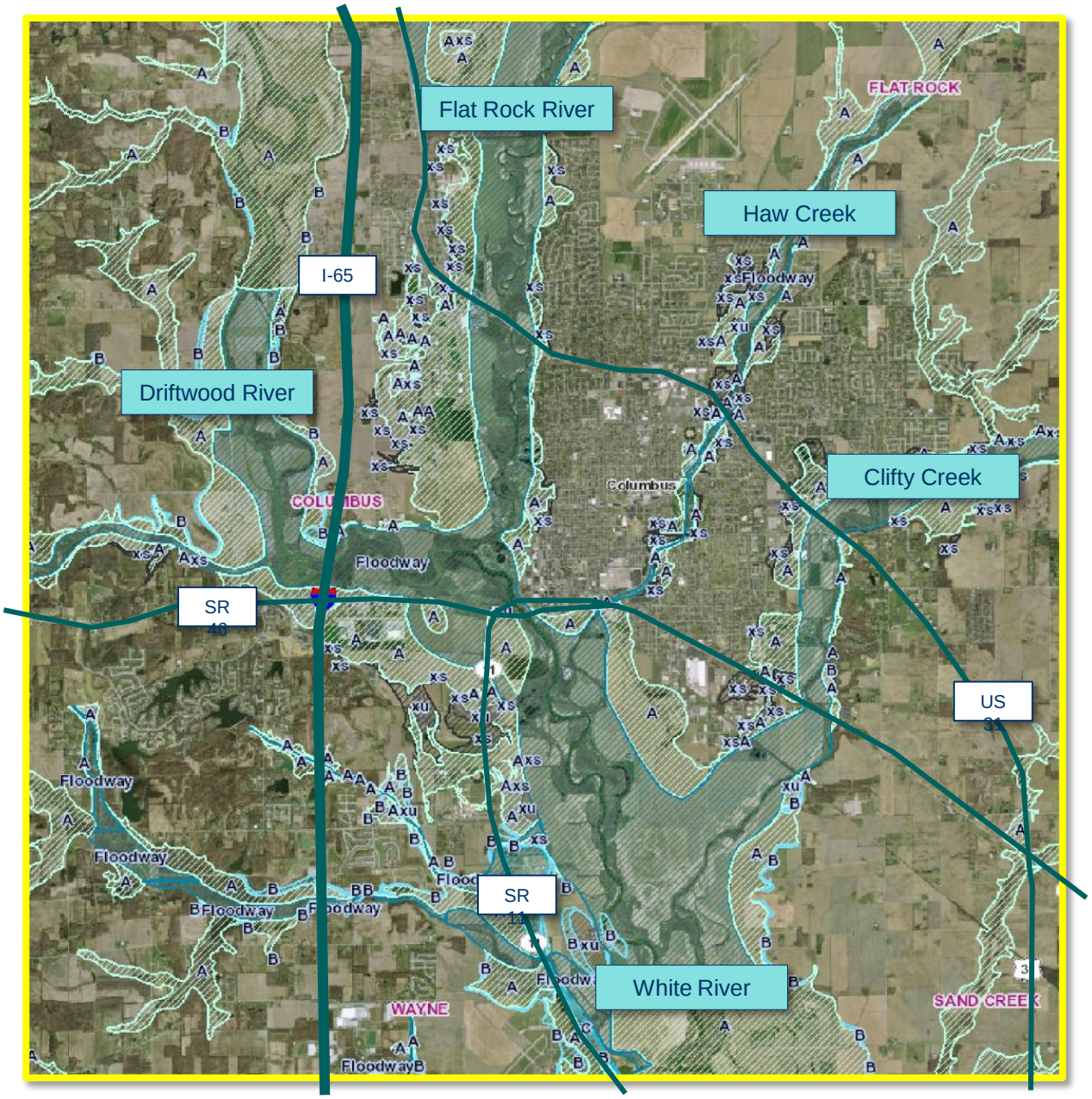
Today's Talk

- Overview of June 2008 Flooding in Columbus
- Haw Creek Flood Risk Mitigation Study
  - What is the ***extent*** of the flood risk along Haw Creek?
  - What can be done to ***reduce*** the flood risk?
  - How can the community ***prepare*** for floods and reduce damages?
  - How do the community and county ***prevent*** the flood risk from becoming worse?
- Community's Initial Regulatory Response
- Next Step: City of Columbus Flood Risk Management Plan

Bartholomew County Floodplains



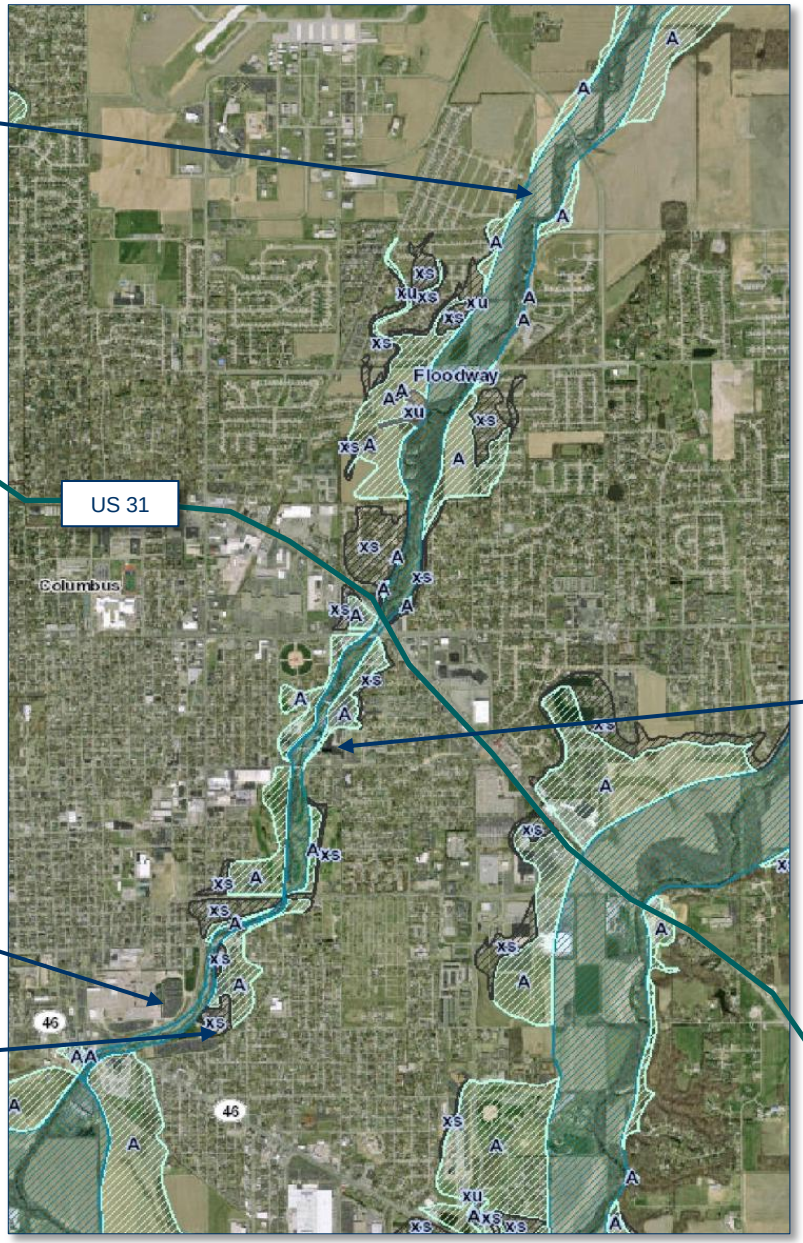
Columbus-area Floodplains



Floodplain Philosophy

- Floodways are to be avoided (due to flood risk + lengthy approval process).
- Flood fringe areas play a key role in Columbus' growth and development; specifically for commercial and industrial sites (because of their geographic locations and land area coverage).
- Floodplain regulations follow the minimum FEMA / IDNR requirements (with some minor additions, i.e.: building protection also required in the 500-year floodplain).
- Floodplain regulations generally perceived as a nuisance by developers, home-owners, etc.
- "This property has never flooded!" / "How can I avoid paying flood insurance?"

Haw Creek in Columbus



Haw Creek Floodplain

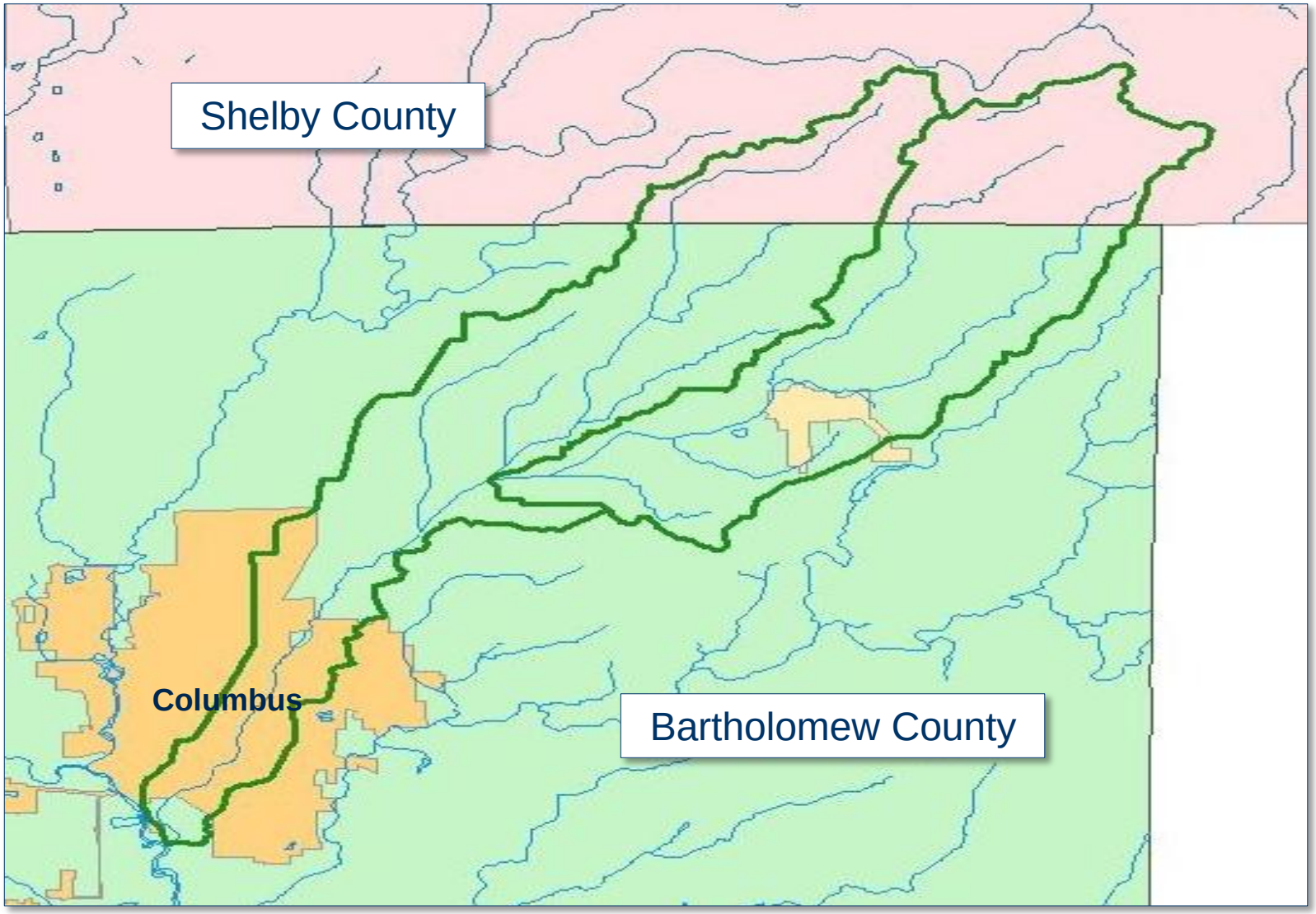
US 31

Columbus Regional Hospital

Cummins Plant 1

Cummins Tech Center

Haw Creek Watershed



Cummins Tech Center

Columbus Regional Hospital

CRH Office Building

First Financial Bank - Eastbrook

June 7, 2008


GIRLS BASKETBALL 2007 STATE RUNNER-UP
FOOTBALL 2006 FINAL FOUR
FOOTBALL 2004 FINAL FOUR
GIRLS VOLLEYBALL 2003 STATE FINALIST
GIRLS BASKETBALL 1997 STATE FINALIST
WELCOME TO THE
CHANGE PIT
RESTROOM

June 7, 2008

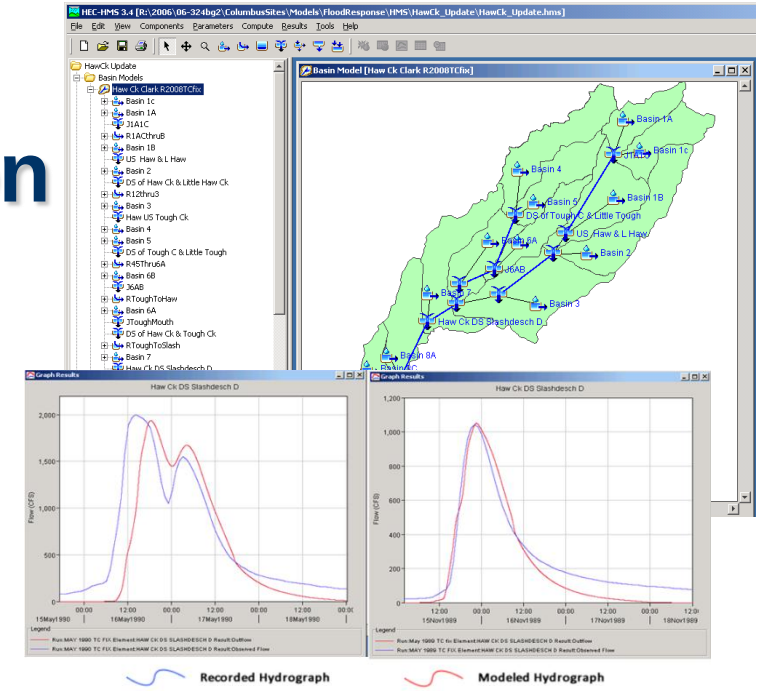
- 3 deaths.
- +/- 3,000 homes damaged or destroyed.
- +/- $500,000,000 in property damage.
- Damaged structures include:
  - Columbus Regional Hospital (closed 6 months for repairs).
  - Cummins Columbus Tech. Center, Engine Plant #1 and Child Care Center
  - Columbus East High School
  - Bartholomew County REMC Offices/Shop
  - Mariah Foods Facility

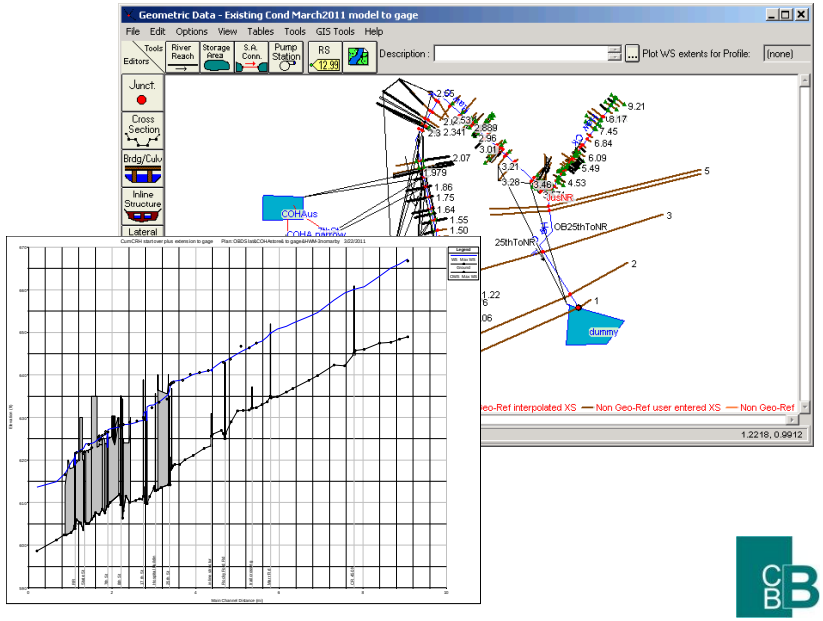
Haw Creek Flood Risk Mitigation Study

- What is the ***extent*** of the flood risk along Haw Creek?
- What can be done to ***reduce*** the flood risk?
- How can the community ***prepare*** for floods and reduce damages?
- How do the community and county ***prevent*** the flood risk from becoming worse?

Flood Risk Identification Detailed Modeling

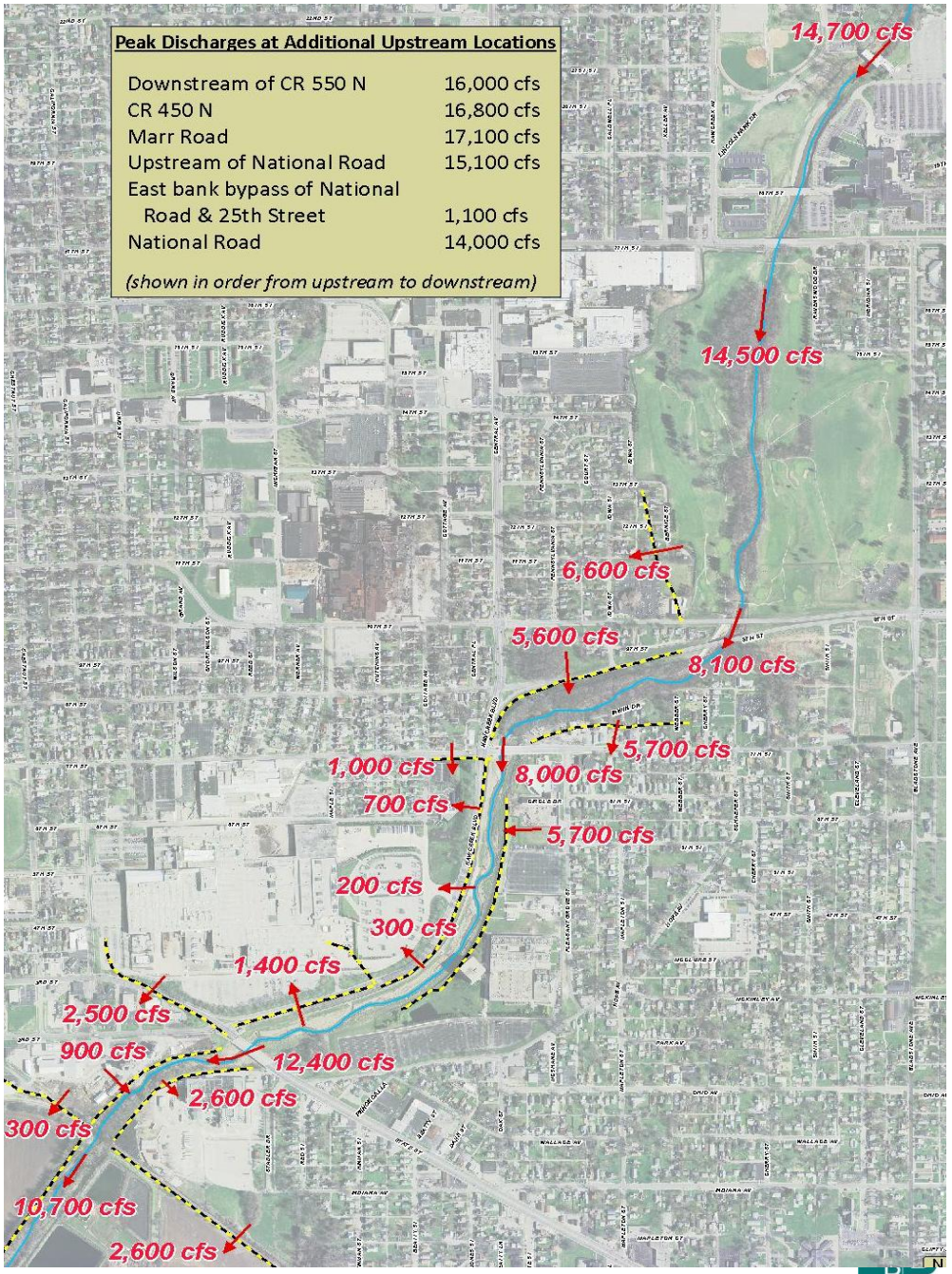
- rainfall-flow model of entire watershed to determine incoming flow upstream of Columbus - calibrated
- flood elevation model through Columbus to determine expected flood depths by reflecting flood flow interactions between the stream, storage areas, levees, bridges, and other obstructions - calibrated



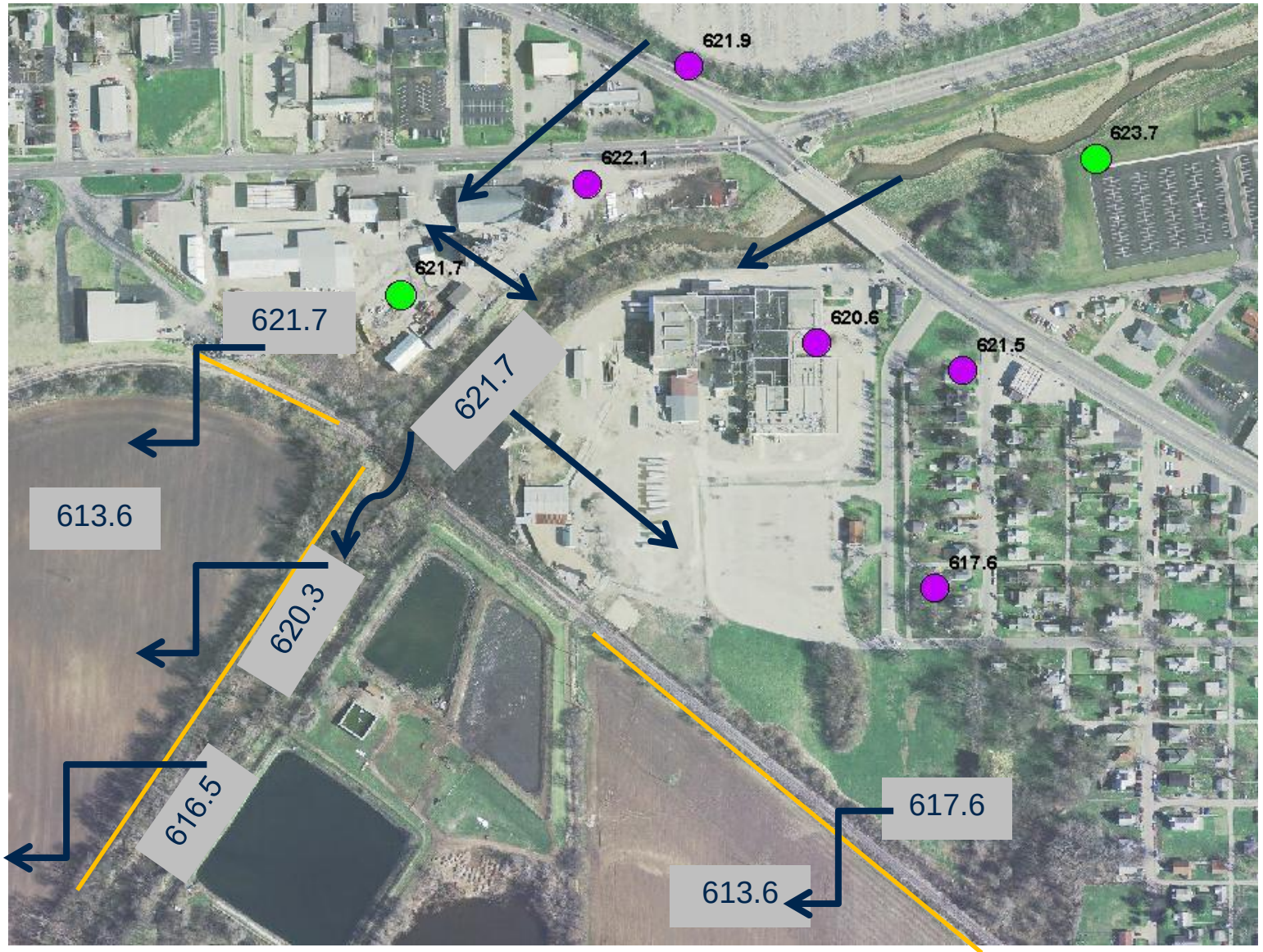


Flood Risk Identification - Results

- Flow Complexities
  (2008 flood)
- Downstream channel – handles only about 6,000 cfs before flooding
  - 35% of 2008 total flow

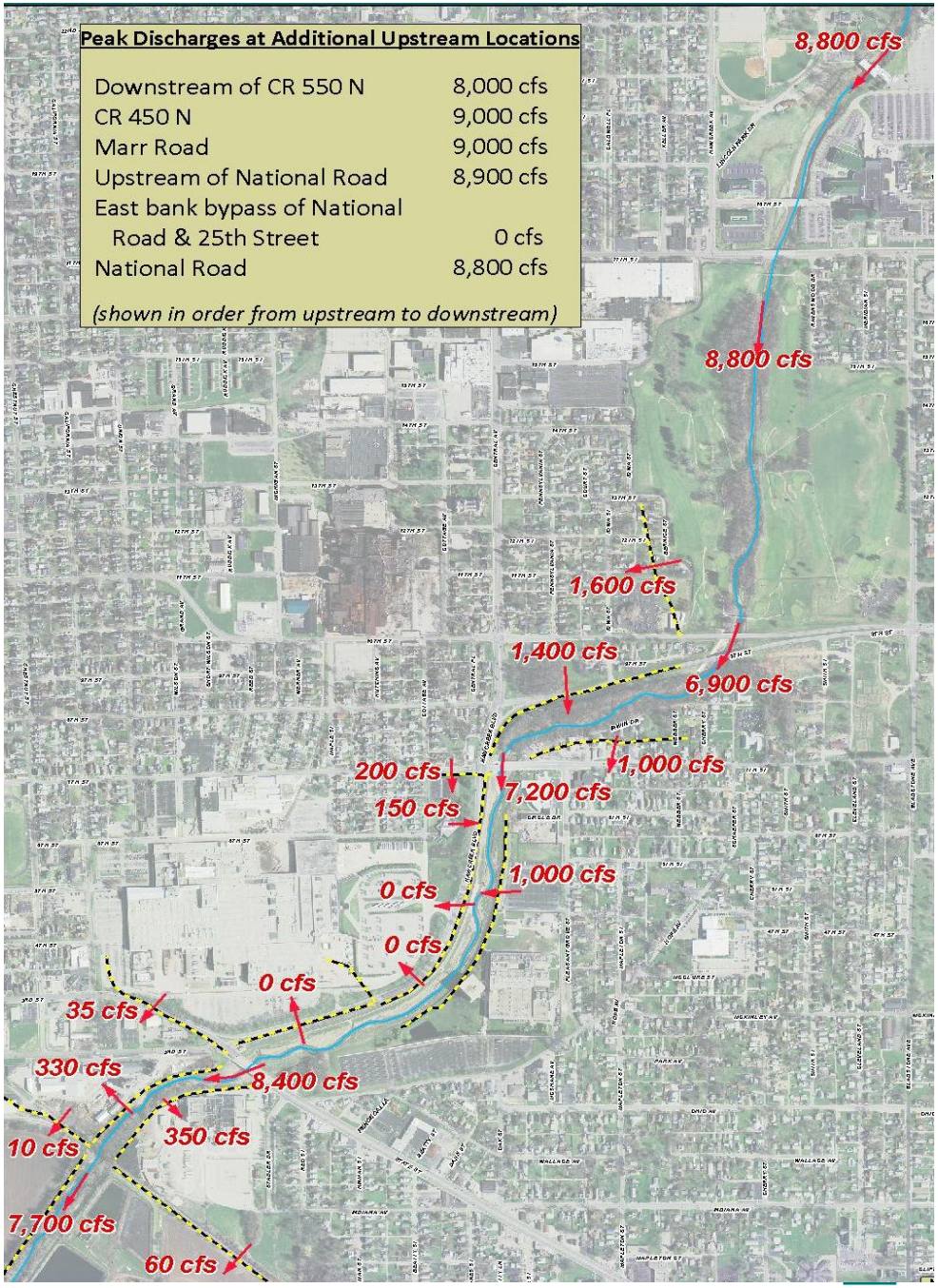


Flood Risk Reduction – RR Impact



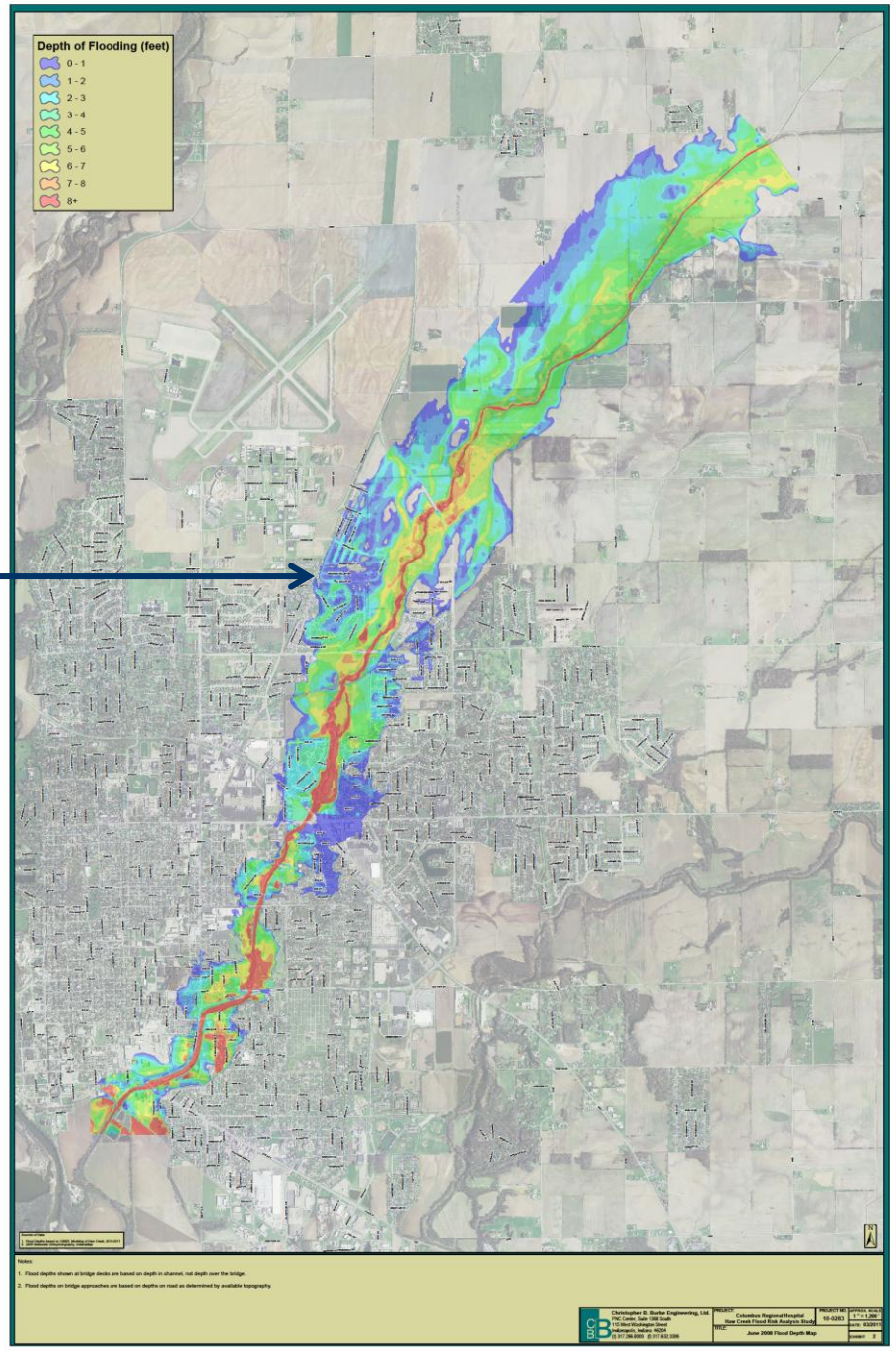
Flood Risk Identification - Results

- Flow Complexities
  (100-year flood)
- Downstream channel – handles only about 6,000 cfs before flooding
  - 65% of 100-year total



Flood Risk Identification - Results

- Flood Depth Mapping
  - ✓ **2008**
  - ✓ 500-year
  - ✓ 100-year
  - ✓ 50-year
  - ✓ 25-year
  - ✓ 10-year




Clifford
) cfs at USGS gage with 4 feet of flood depth
E 450 N
USGS Gage
© 2011 Google
Image IndianaMap Framework Data
2008 Flood Depths
Google

Haw Creek Flood Risk Mitigation Study

- What is the ***extent*** of the flood risk along Haw Creek?
- What can be done to ***reduce*** the flood risk?

- How can the community ***prepare*** for floods and reduce damages?
- How do the community and county ***prevent*** the flood risk from becoming worse?

Flood Risk Reduction - Initial Alternatives

Wide Range of Possible Alternatives Considered:

- Dredge channel
- Flood control reservoir upstream
- Off-line detention pond upstream
- Increase downstream bridge capacities
- Increase downstream outlet capacity (e.g. by pipe to bypass reach between 7th and State Street, add pipes under RR, increase capacity of flow to RR overflow…)
- Upstream diversion to another watershed
- Remove debris, woody vegetation, etc. from channel
- Buyout of homes and small commercial buildings
- Floodproofing of individual buildings of large industries/hospital

Flood Risk Reduction – Rejected Alternatives

•Dredge channel	•no room to construct
•Flood control reservoir upstream	•Costly ($200M+ to accommodate the 2008 flood), liability issues, no good location
• Increase downstream bridge capacities	•minimal benefits, negative impacts downstream of bridges
•Increase downstream outlet capacity	•large cost for the benefit or causes increased frequency of flooding in area near RR
• Upstream diversion to another watershed	•costly ($80M to accommodate the 2008 flood), negative impacts to receiving watershed, multi-years for permitting and land acquisition

Flood Risk Reduction - Feasible Alternatives

- Clear debris & woody vegetation from channel
- Voluntary buyouts or individual site flood protection

Haw Creek Flood Risk Mitigation Study

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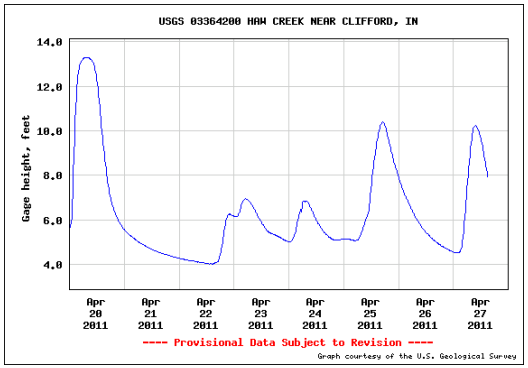
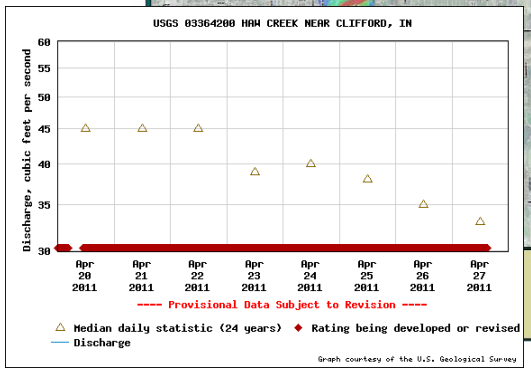
Flood Risk Preparedness – USGS Stream Gages

Reestablished USGS stream flow gages near Clifford and at Hope provide:

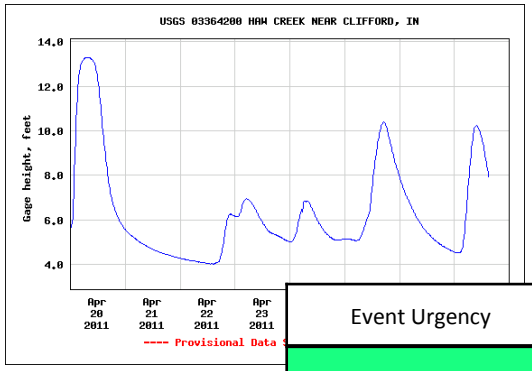
- Hourly gage elevations



- Discharge measurements for future calibration



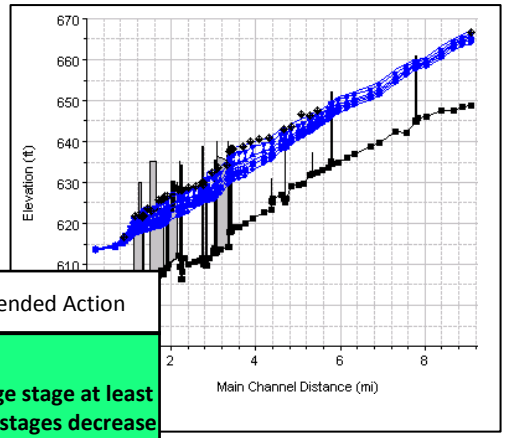
Flood Risk Preparedness – USGS Stream Gages



Stream gage data

\+ model data

warning tool



Event Urgency	USGS Gage at Clifford Stage, feet	Potential Impact	Recommended Action
Watch	**14.7**	**Anything from no flood impact at the hospital to overtopping of the loading dock in 5 hours, depending on the extent of further rise in stages at the gage**	**Monitor gage stage at least hourly until stages decrease and area rainfall stops**
Warning	**15.3**	**Anything from no flood impact at the hospital to overtopping of the loading dock in 4 hours, depending on the extent of further rise in stages at the gage**	**Continue to monitor gage stage at least hourly until stages decrease and area rainfall stops**
Emergency 1	**15.8**	**Flooding of hospital basement via the loading dock entrance likely in approximately 3 hours**	**Protect the facility if such measures are available.**
Emergency 2	**16.8**	**Flooding of 17th Street to the west of the hospital likely in approximately 4 hours cutting off direct access from the west**	**Make sure emergency vehicles are notified of the potential need to use alternate routes**

Flood Risk Preparedness – Flood Response Plan

- Provides guidance for:

  1. Event Detection and Severity Level Determination
  2. Notifications and Communications
  3. Expected Actions
  4. Termination and Follow-up

- Specific to each at-risk area within the Corridor:

  - ❑Various neighborhoods
  - ❑Major streets and roads
  - ❑Hospital
  - ❑Industries
  - ❑Other major facilities

Haw Creek Flood Risk Mitigation Study

- What is the ***extent*** of the flood risk along Haw Creek?
- What can be done to ***reduce*** the flood risk?

- How can the community ***prepare*** for floods and reduce damages?
- How do the community and county ***prevent*** the flood risk from becoming worse?

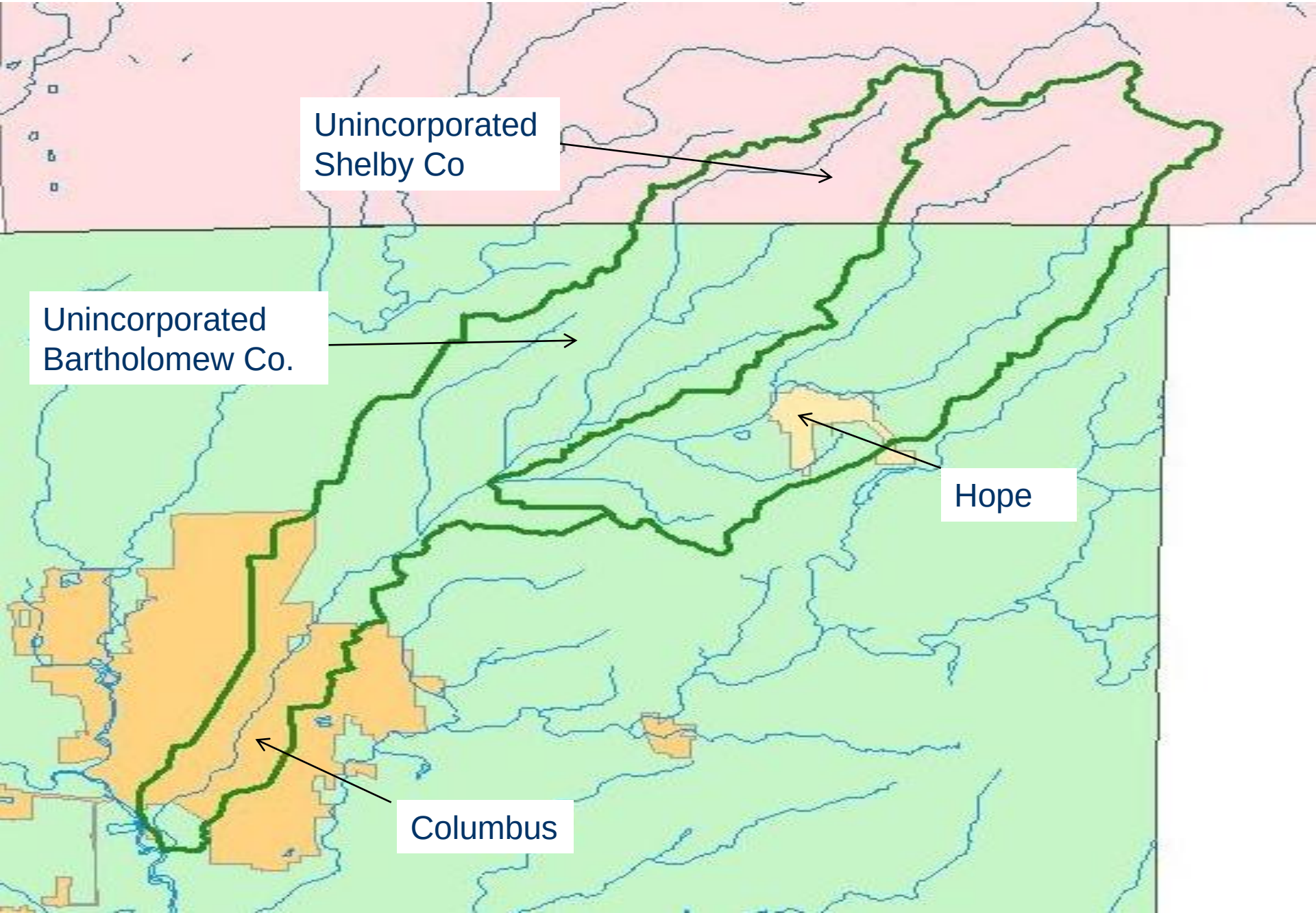
Can it Get Worse?!

- Unfortunately, yes it can get worse!
- Flood Stages can increase due to:
  1. Increase in streamflow peaks
     - Due to urbanization within watershed
     - Due to loss of floodplain storage
  2. Loss of flow conveyance within river corridor
  3. Blockage of auxiliary flow paths

Watershed Urbanization Impacts

- Must compensate for increased imperviousness!
- If the impacts are not adequately addressed:
  - Expect increase in peak flows downstream
  - Expect increased channel streambank erosion downstream
- Both the City and the County(s) must adopt and enforce the new requirements

Haw Creek Watershed Jurisdictions



Loss of Floodplain Storage Impacts

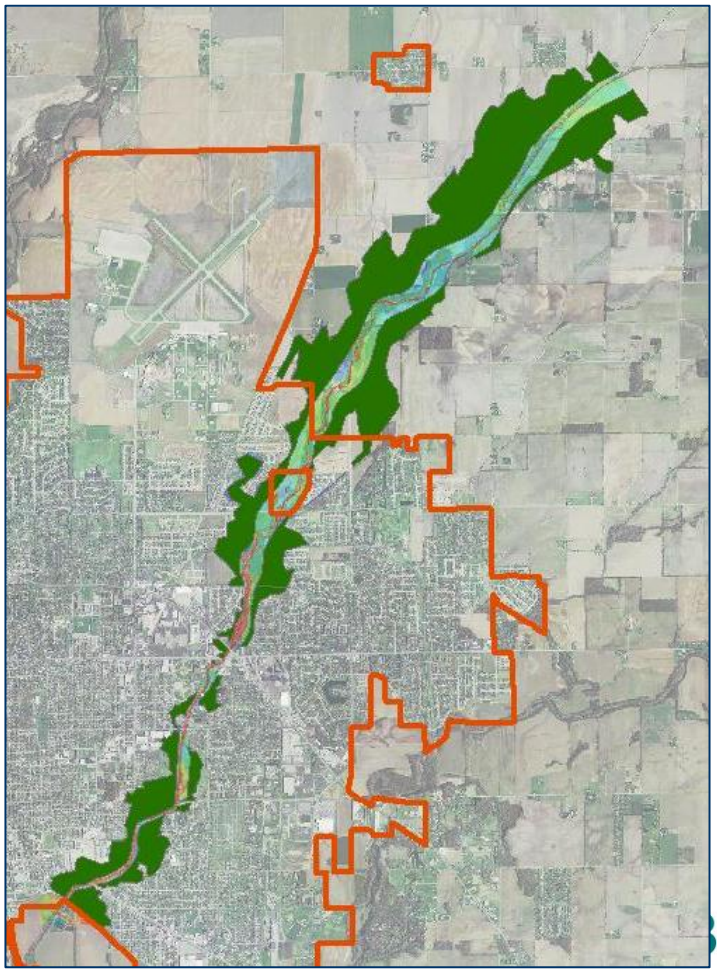
If fringe areas shown in green were filled as allowed by current ordinances:

Impact on **100-year** peak flood elevations

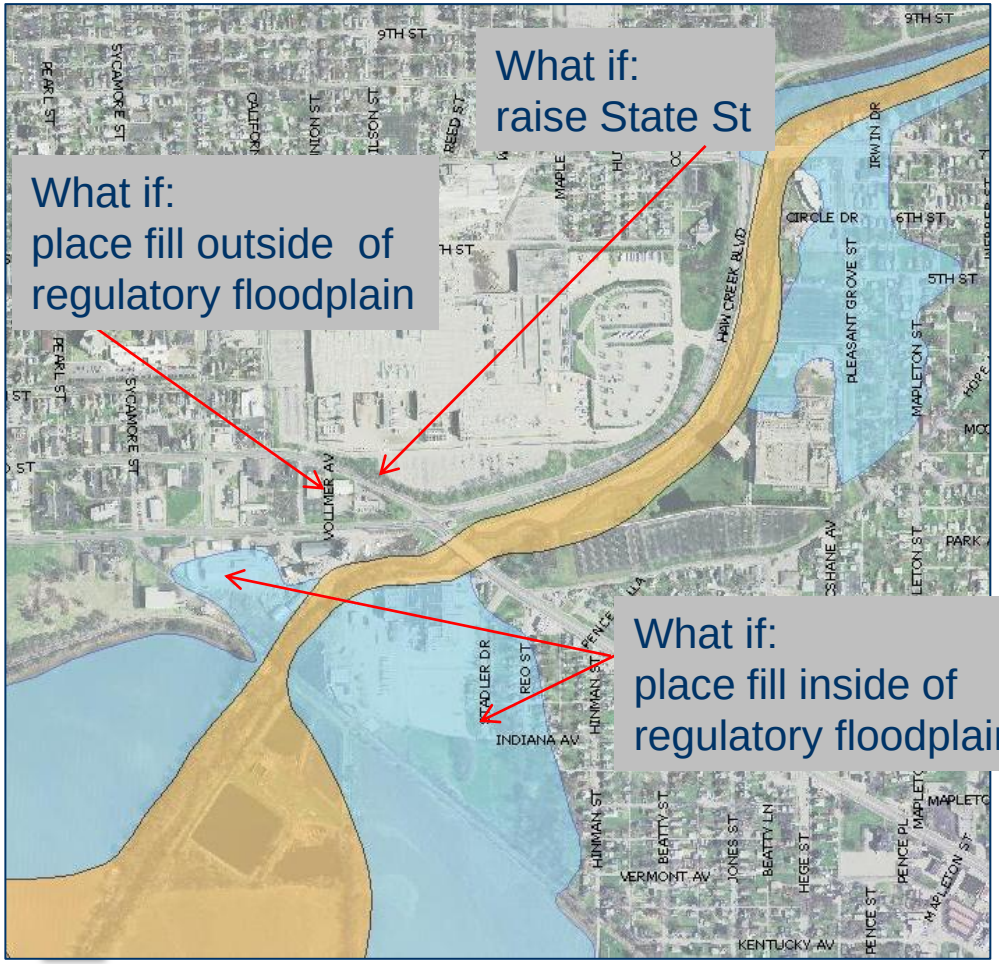
- **½ - 1 ½ foot increases** upstream of National Road
- **1 – 1 ¼ foot increases** downstream of National Road

Impact on **June 2008** peak flood elevations

- **3 foot increases** upstream of 7th Street
- **varying increases** other areas



Blockage of Auxiliary Flow Path Impacts



…and thus block flow paths

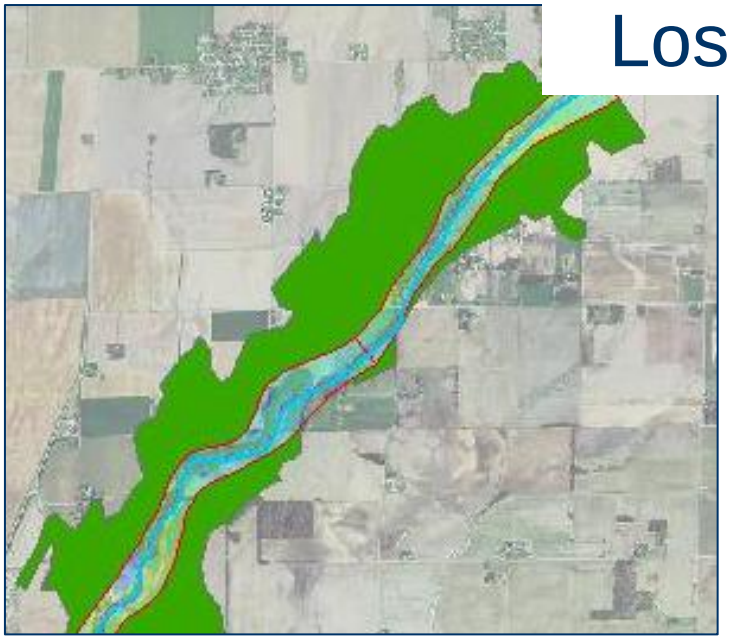
Impact on **100 year** peak flood elevations

- up to **0.4 ft increase** in creek downstream RR to 8th St
- **decrease** at Cummins engine plant

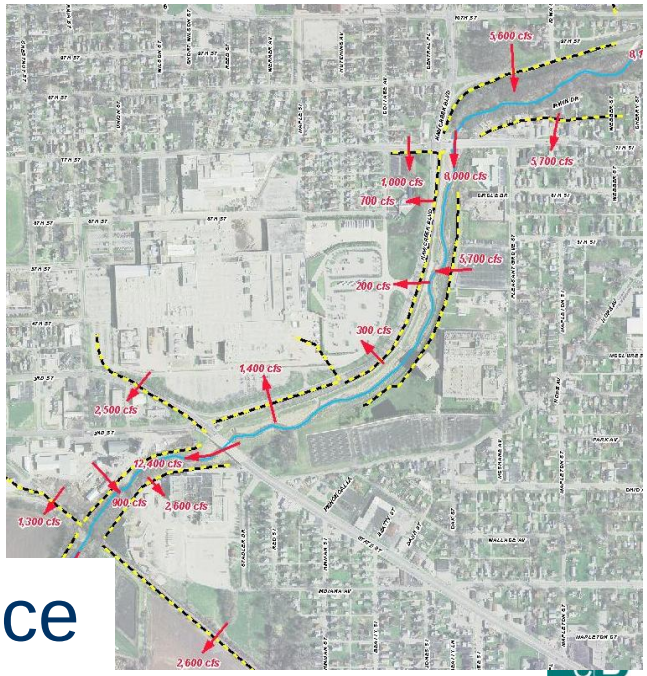
Impact on **June 2008** peak flood elevations

- up to **2 ft increase** in creek downstream RR to 17th St
- over **3 ft increase** at Cummins engine plant

All Impact Culprits Are Not Created Equal



Loss of Floodplain Storage



Loss of Flow Paths/ Conveyance

All Impact Culprits Are Not Created Equal

	Loss of Floodplain Storage	Loss of Flow Paths/ Conveyance
Impact location	▪Increased Flow Dnstream	▪Increased Stage at Site/Upstream
Impact determination	▪Incremental Increase in Flow Usually won't show up in computer modeling	▪Conveyance calculation models ▪Additional detailed modeling when split flow paths occur
Degree of impact	▪Less visible impacts until large areas are lost ▪Gradual ▪Cumulative ▪Can also happen when storage is reduced by an increase in outlet capacity (e.g., bridge/ culvert openings, pond outlets, etc)	▪Noticeable impact can result from even small losses in conveyance ▪Impacts show up immediately ▪Cumulative

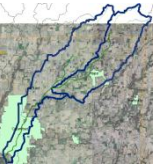
If Action is Taken:

Such conditions can be prevented…

Flood Risk Increase Prevention – Recommended Compensation

Compensation Measure >>>	Require New Dev meet allowable release rates	Min.1:1 compensation of lost floodplain storage area	Add flow area to offset any cumulative WSEL increases >0.1 ft
Level at which to start evaluation	▪Any site in the watershed (typically over 0.5 to 1 Acre)	▪Loss of active FP storage area (not including unplanned storage areas, inside buildings, or immediate area)	▪Any fill/change to floodway or auxiliary flow path (use CBBEL map for 2008 flood paths along Haw Ck)
Compensation location	▪Where allowable release rate from the site is met (outlet)	▪Immediate watershed ▪Upstream if possible ▪Connected to same zone that's loosing storage (10 yr FP, 50 yr FP…)	▪Create new flow path or increase flow area where needed
Evaluation Methodology	▪Detailed Hydrologic Modeling	▪Comparison of cut/fill volumes	▪Detailed modeling to show if significant increase in WSEL

Flood Risk Increase Prevention – Regulatory Levels

Compensation	Require detention w/ max allowable release rates	1:1 compensation of lost floodplain storage area	Add flow area to offset any cumulative WSEL increases >0.1 ft*
 Haw Ck Watershed	X		
 Inside 100 yr FPs	X	X	
Inside floodways	X	X	X
 Inside Haw Ck 2008 auxiliary flow path	X	X	X
Inside Haw Ck 100-yr auxiliary flow path	X	X	X

* Design & evaluate for 100-year flood, but check impacts for smaller and larger floods

Next Steps for Haw Creek: <u>Prepare</u> for Flooding

- Retain USGS stream gauges
- Install rainfall gauges
- Develop a comprehensive Flood Response Plan
- Develop a flood forecasting model
- Distribute public education/outreach material

Next Steps for Haw Creek: Prevent an Increase in Flooding

- Immediately designate and declare the Haw Creek Watershed as “Impacted Watershed”
- Require future projects on Haw Creek to be evaluated with a detailed unsteady-state model (such as that developed by CBBEL)
- Require compensation for placing fill or eliminating floodplain storage (City and Counties)
- Adopt Allowable Release Rates for post- development 100-year and 10-year storm events (City and Counties)
- Pursue sustainable funding for ongoing maintenance of Haw Creek

Next Steps for Haw Creek: Reduce Vulnerability to Flooding

- Pursue voluntary buyout of residential and small commercial properties (FEMA or other sources)
- Encourage/allow/undertake individual site protection, evaluating for “No Adverse Impact”
- Remove debris and woody vegetation from Haw Creek channel

Community's Response to Haw Creek Flood Risk Mitigation Study

Haw Creek Study Context – May 2011

- Public interest in floodplain issues continues at a high level, but is decreasing. Some still question "what caused the flood?" – log jams, a new bridge, specific recent developments….?
- City-initiated athletic complex proposed in the Haw Creek floodplain brings new public attention to floodplain issues.
- Columbus and Bartholomew County Plan Commissions form joint committee to review existing floodplain development regulations and recommend changes.
- "Haw Creek Task Force" explores designation of Haw Creek as a regulated drain ("log jams, silt and trees caused the flood").
- Local political candidates advocate for a "comprehensive flood management plan".
- Columbus Regional Hospital begins flood wall construction.

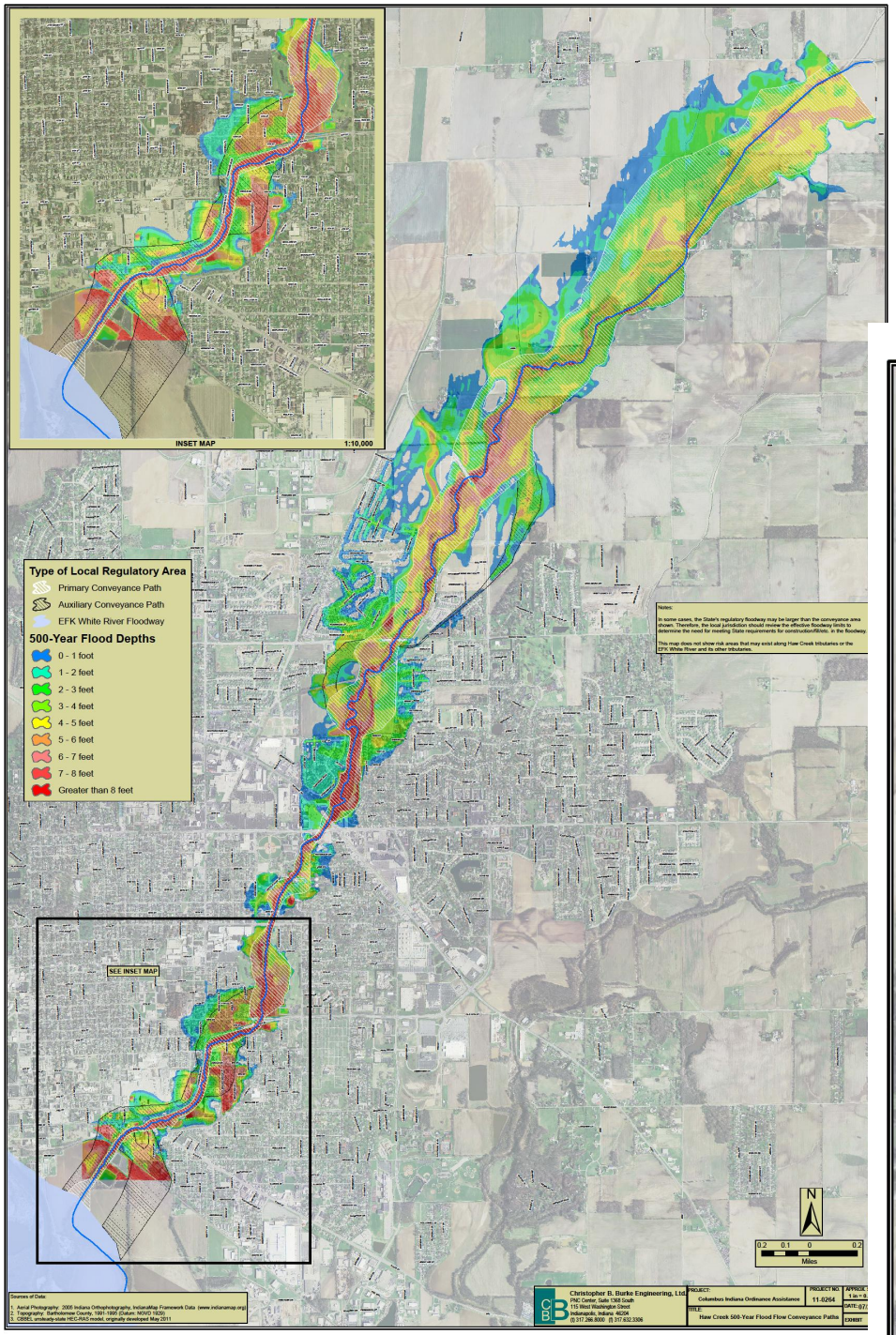
Columbus Response

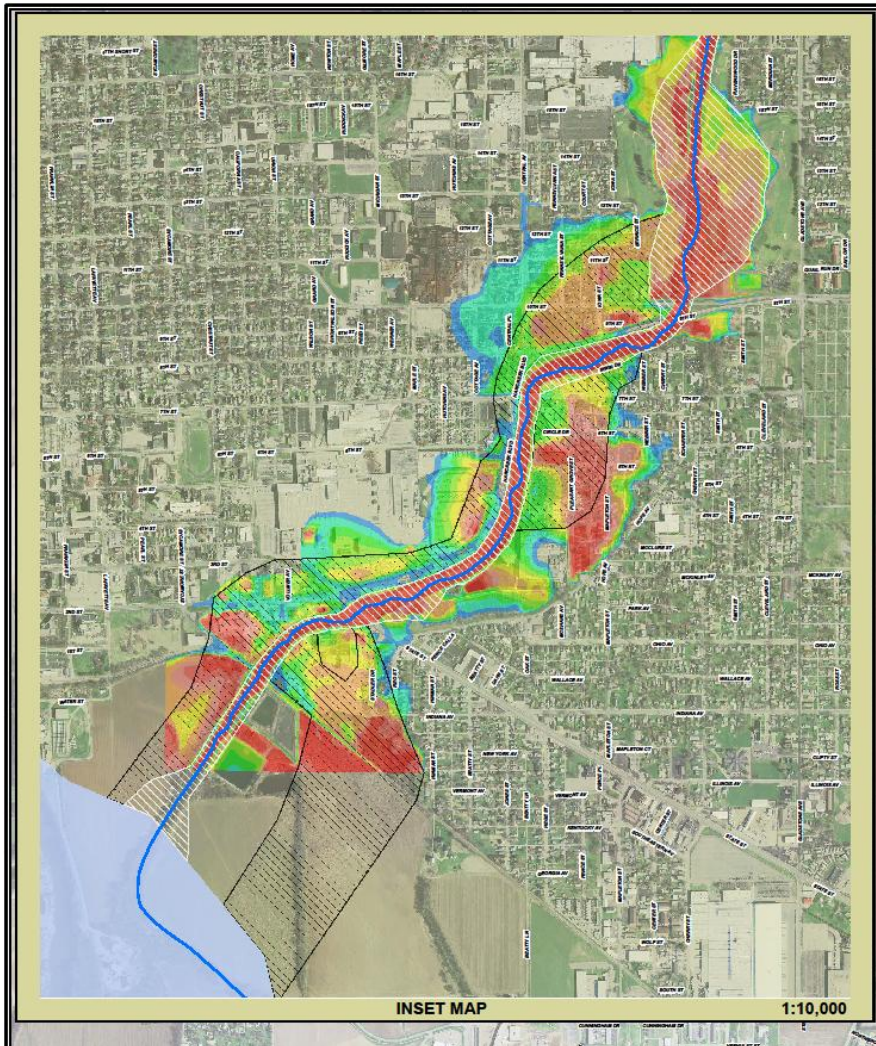
- October 2011: Columbus City Council adopts supplemental regulations for the Haw Creek watershed.
  - Burke-produced maps and elevations adopted as supplements to FIRM maps – flood protection requirements extended to the "new" 500-year floodplain.
  - Modeling required for all development in Burke-identified "flow conveyance paths". Maximum cumulative allowable increase in 500-year flood heights = 0.1 feet.
- October 2011: Compensatory storage recommendations referred to the City-County Flood Regulation Study Committee for county-wide consideration.
- January 2012: City-initiated athletic complex project cancelled due in-part to costs of mitigating newly-identified floodplain impacts.

Columbus Response (continued)

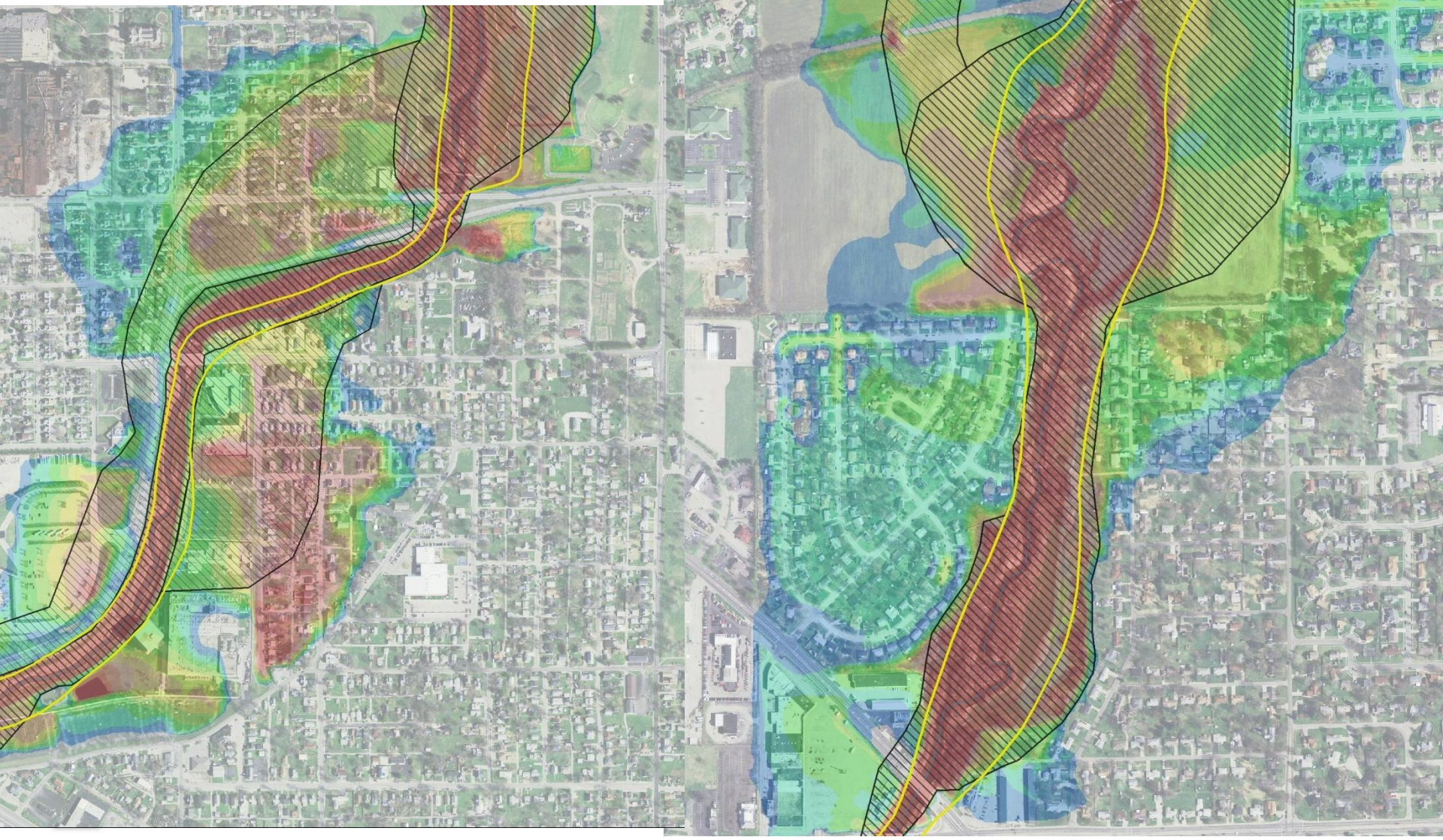
- February 2012: Cummins Tech Center flood wall is the first project reviewed under newly-adopted Haw Creek regulations.
- March 2012: Columbus issues RFQ for comprehensive flood management plan, which will include:
  - recommended development regulations (from study committee),
  - mitigation options and cost/benefit analysis,
  - flood warning system, and
  - flood event emergency plan (evacuations, etc.).

Proposed 500-Yr "Conveyance Path"



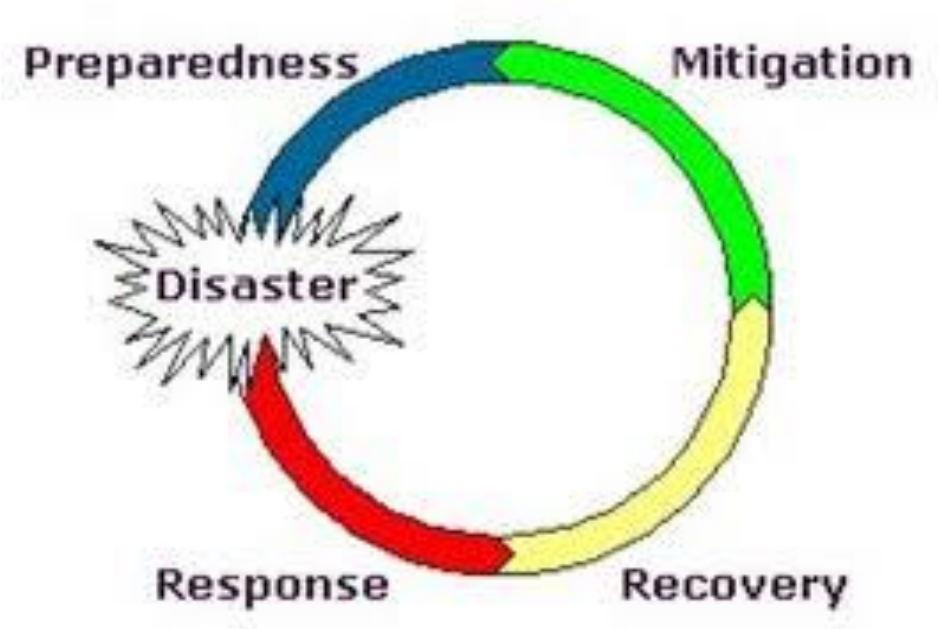


Way Beyond FEMA/IDNR Floodway (No-Adverse-Impact)

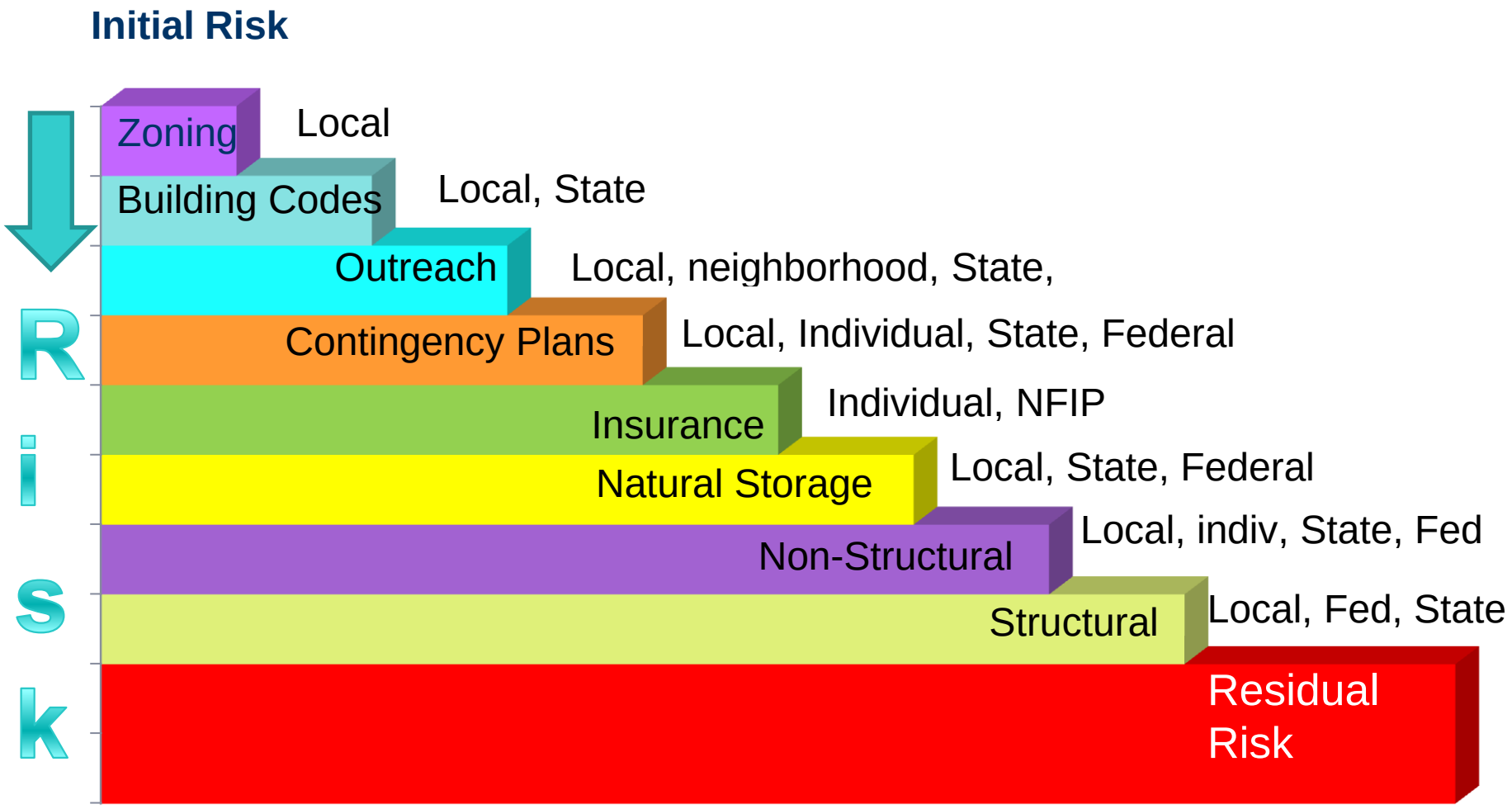


NEXT STEP

Preparation of a comprehensive City of Columbus Flood Risk Management Plan



Shared Flood Risk Management: Buying Down Risk



Risk Reduction Tools (Cumulative)

All stakeholders contribute to reducing risk!

QUESTIONS?

Jeff Bergman, AICP

Planning Director

City of Columbus - Bartholomew County Planning Department

123 Washington Street

Columbus, Indiana 47201

ph: 812.376.2550

e-mail: jbergman@columbus.in.gov

Siavash Beik, PE, CFM, D.WRE

Director, Water Resources

Christopher B. Burke Engineering, LLC

115 West Washington Street, Suite 1368 South

Indianapolis, IN 46204

Ph: 317.266.8000

Email: sbeik@cbbel-in.com